A.D. 1865, 20th Mar. N° 1390.

Telegraph Supports, &c.

LETTERS PATENT to Cornelius Varley, of 337, Kentish Town Road, in the County of Middlesex, and Samuel Alfred Varley, of 66, Roman Road, Holloway, in the said County of Middlesex, Telegraph Engineers and Contractors, for the Invention of "IMPROVEMENTS IN TELEGRAPH SUPPORTS, PARTS OF THE INVENTION BEING APPLICABLE TO OTHER PURPOSES."

Sealed the 31st October 1865, and dated the 20th May 1865.

PROVISIONAL SPECIFICATION left by the said Cornelius Varley and Samuel Alfred Varley at the Office of the Commissioners of Patents, with their Petition, on the 20th May 1865.

We, CORNELIUS VARLEY, of 337, Kentish Town Road, in the County of Middlesex, and SAMUEL ALFRED VARLEY, of 66, Roman Road, Holloway, in the said County of Middlesex, Telegraph Engineers and Contractors, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN TELEGRAPH SUPPORTS, PARTS OF THE INVENTION BEING APPLICABLE TO OTHER PURPOSES," to be as follows:—

The object of our Invention is an improved construction of telegraph posts or supports, by which greater economy is effected in their erection and strength obtained to resist strain. Our Invention is chiefly applicable to poles constructed of iron, but it is applicable to all telegraph poles, and parts of it to any pillar or post which is subjected to strain. An important feature

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of our Invention is that the power to resist strain is in a great degree independent of the regidity of the upright, consequently iron or wooden uprights of a much lighter description than generally used can be employed. We construct our poles; when of iron, by preference of ordinary gas barrel made of the requisite length and diameter; on the lower end of the gas barrel we generally cast a piece of iron, or a piece of wrought iron can be forged on to it, or the tube itself closed; this makes the lower termination of the pole, which we prefer to be taper and 4-sided; this termination is fitted into a hole, which corresponds in shape to it, cut into a block of stone, or a wooden sleeper, or a plate of cast iron may be cast with a suitable fitting for it, but any suitable material may be employed to form the base. We prefer in most cases a cast-iron plate, which we make of sufficient surface to resist being forced into the ground, and we generally make it square, for the convenience of packing, with a boss in the centre containing a suitable hole for the termination of the pole; and to obtain strength combined with lightness ribs are usually cast on the iron plate.

A part of this Invention consists of a novel kind of mooring; this mooring has an iron rod attached to it, with a link or eye at one end, and is made of such a shape that it can readily be forced into the ground with a suitable tool, and is of such a construction that on being submitted to strain it opens something like a pair of scissors or a hinge, exposing a great surface, and offering very great resistance. To render the opening of the moorings more certain when submitted to strain, before filling the hole with earth a wedge is usually driven down, which partly opens them. When gas barrel is used for the upright or pole, upon the upper portion we usually cast a piece of cast iron, which we call the arm piece; this piece is made of a suitable shape for attaching a wooden arm, which carries the insulators; the insulators may, however, be attached by suitable brackets to the pole direct, and the wooden arms dispensed with. Stay wires attached at the one end to the moorings are looped round the arm piece and brought down to the moorings again. To keep the stay wires in their place we usually cast the arm piece with two flanges, one at the lower part and the other higher up, and connect the two with pillars, forming a sort of cage. To erect the pole all that is necessary is to mark out the place for the pole and the moorings; four moorings will generally be sufficient. The block of stone or sleeper or cast-iron plate to receive the end of the pole is laid upon the surface of the ground or sunk into the earth a short distance. The moorings are then driven into the ground, and generally forced open to a certain extent by driving down a wedge; earth is then rammed down and the holes filled. The stay wires (one for

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each mooring is generally sufficient) are then threaded through the iron cage of the arm piece and round the pole; the two ends of each wire are then brought down to a mooring. The upright or pole is then erected and the stay wires are (after being passed through the links of the moorings) tightened by draw vices or other suitable means until the pole or upright stands vertical. The two ends of each stay wire are then joined together and the draw vice removed. Any strain the telegraph wire may be subjected to is almost entirely borne by the stay wires, and as the strain is almost entirely one of tension they may be made of comparatively light wire. On the mooring links we generally place a pulley or friction roller to lessen the friction when tightening the stay wires. In some cases to obtain greater strength, and also greater equality in the tension of the stay wires, we fit castings, which we call stay pieces, on the upright or pole; these castings slide freely on the upright, but can be fixed in any position either by a screw or other suitable means; two of these stay pieces are generally sufficient. The stay wires are then arranged in a somewhat different way to that previously described. One plan is to fasten the one end of the stay wire to the link of one of the moorings at the side of the friction roller or pulley, then thread the stay through the cage of the arm piece, round the upright and down again to the same mooring, and place it round the pulley or friction roller attached to the link of the mooring; the end of the stay wire is then taken up to the upper stay piece and passed over the groove of a fixed pulley or portion of a pulley attached to it. The wire is then brought down again to the opposite mooring, the stay wire passed round the friction roller or pulley in the link of this mooring, then up to the arm piece, through the cage, and round the upright, and down to the link of the mooring, where it is firmly fastened; a second stay is arranged, generally at right angles to the first one, and attached in the manner previously described to two other moorings, and passed over the 2nd stay piece in a similar way. The upper stay piece is then forced up the upright by an apparatus constructed for the purpose, or by any other suitable means. The apparatus for the purpose above mentioned forms no part of our Invention, nor is any claim laid thereto. The effect of this is to bring an equal strain on the stay wires on the opposite sides of the upright or pole, the stay piece is then fixed, and a key driven in, which is so arranged that it fastens this stay wire and prevents it slipping. The second stay piece is then forced up and fixed in exactly the same way as the first. The stay wires may be arranged somewhat differently to that described, and a greater number of moorings may be employed, if desirable. Wire rope or twisted wires may be employed for the stays. To

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save the necessity of carrying ladders when erecting a telegraph line we sometimes employ an arrangement which is attached to the pole, and forms steps, and is so constructed that the pressure of the foot fixes it to the upright, and on the pressure being removed it can readily be shifted to any other position, but this arrangement forms no part of our Invention. In places confined for room, such as the sides of railways, or where great regidity is required, as is the case where the wires terminate, we usually construct our poles of two uprights, and attach the wooden arms which carry the insulators to both in such a way that they act as ties or braces to the poles, and we usually place one, two, or more lower down the uprights to increase their stiffness; these double poles are generally stayed in the way previously described with the single uprights, but where very great regidity is required the arms which carry the insulators may project beyond the uprights, and the stay wires be attached to them.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Cornelius Varley and Samuel Alfred Varley in the Great Seal Patent Office on the 14th November 1865.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, CORNELIUS VARLEY, of 337, Kentish Town Road, in the County of Middlesex, and SAMUEL ALFRED VARLEY, of 66, Roman Road, Holloway, in the said County of Middlesex, Telegraph Engineers and Contractors, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twentieth day of May, in the year of our Lord One thousand eight hundred and sixty-five, in the twenty-eighth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Cornelius Varley and Samuel Alfred Varley, Her special licence that we, the said Cornelius Varley and Samuel Alfred Varley, our executors, administrators, and assigns, or such others as we, the said Cornelius Varley and Samuel Alfred Varley, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN TELEGRAPH SUPPORTS, PARTS OF THE INVENTION BEING APPLICABLE TO OTHER PURPOSES," upon the condition (amongst others) that we, the said Cornelius Varley and Samuel Alfred Varley, our executors or administrators, by an instrument in writing under our, or one of our, or their, or one of their

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hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Samuel Alfred Varley, on behalf of myself and the said Cornelius Varley, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The object of our Invention is an improved construction of telegraph posts or supports, by which greater economy is effected in their erection and greater strength obtained to resist strain. Our Invention is chiefly applicable to poles constructed of iron, but it is applicable to nearly all telegraph poles, and parts of it to any pillar or post which is subjected to strain. An important feature of our Invention is that the power to resist strain is in a great degree independent of the rigidity of the upright, consequently iron or wooden uprights of a lighter description than generally used can be employed. We construct our poles, when we make them of iron, by preference of ordinary gas barrel, of a diameter suitable to the strength required. On one end of the gas barrel we generally cast a piece of cast iron *b*, Fig. 1, or a piece of wrought iron can be forged on to it, or the end of the barrel itself closed; this makes the lower termination of the pole, which we prefer to be taper and 4-sided, as shown in the top and under view of the base, Figs. 2 and 3. This termination is fitted into a hole, which corresponds in shape to it, cut into a block of stone, or a wooden sleeper, or any other suitable material which may be employed to form a base to the pole. We prefer in most cases to employ a cast-iron plate, which we make of sufficient surface to resist being forced into the ground, and we generally make it square for the convenience of packing, with a boss in the centre containing a suitable hole *a* for the termination of the pole to fit into, and to obtain strength combined with lightness; ribs are usually cast on the iron plate; Fig. 2 is a top view of this plate; Fig. 1 shows it in section; Fig. 3 is a view of the under side.

A part of this Invention consists of a novel kind of mooring; this mooring is of such a shape that it can readily be forced into the ground, and is of such a construction that on being submitted to strain it opens in a similar way to a hinge or a pair of scissors, presenting a broad surface, and offering a great resistance to movement; the size and shape of these moorings can be varied according to the resistance they are required to oppose; three shapes are shown, which we call for distinction No. 1, 2, and 3. Figs. 4 and 5 show

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No. 1 mooring in elevation in two positions, ready to be placed in the ground. Fig. 6 shows No. 1 mooring when subjected to strain. *c, c*, Fig. 4, 5, and 6, are two blades working in the joint *d*; *e, e*, are ribs to strengthen the blades of the mooring; *f, f*, is a connecting rod or shank working also on the joint *d*; *g* is a wedge sliding freely on the connecting rod *f, f*; *h* is a pulley working on the end of the shank, which is formed into a loop, as shown in Fig. 4 and 5. When the two blades of the mooring are closed there is a space left between, as shown in Fig. 7, which is a top view of mooring No. 1 when closed; the object of this space is for the insertion of a bar of metal, which we call a driving fork to force the mooring into the ground. Fig. 8 and 9 show in elevation the inside and outside of the blades of No. 1 mooring separated; Fig. 10 shows the two blades of No. 2 mooring separated; the chief difference of this mooring from No. 1 mooring is that there are no ribs on the outside of the blades, consequently it occupies less room and is more easily forced into the ground. The two blades are prevented from opening beyond the desired degree when subjected to strain by cutting away a portion of the knuckle of the joint on both blades, leaving a quadrant, more or less; when the two are opened to a certain extent these quadrants meet and prevent the blades opening further; these quadrants are shown at *i, i*, Fig. 10 and 11. Fig. 12 shows mooring No. 3 closed, without the shank; Fig. 13 shows the same mooring when subjected to strain; Fig. 14 shows the inside of one of the blades of No. 3 mooring; the moorings may be made with 3 or more blades radiating from a centre, or they may be made with only one blade, but we prefer those described as No. 1, 2, and 3; these moorings may be made of common cast or malleable cast iron, or of any other suitable material. Fig. 15 is a bar of metal slotted up the centre at one end, as shown at *k, k*, which we call the driving fork; Fig. 16 is an edge view of the same. When gas barrel is used for the pole upon the upper portion we generally cast a piece of iron, which we call the arm piece, Fig. 17; this piece is made of a suitable shape for receiving a wooden arm which carries the insulators. The lower portion of the arm piece is usually made into a sort of cage by casting it with two flanges *l, l*, connected by two pillars *m, m*. It is convenient sometimes to make the arm piece and the cage in two separate parts, and instead of rigidly fixing them to the pole by casting them on the gas barrel we sometimes make them to slide freely over the pole, and cast them with a key way; they are then fixed in the desired position by driving in a key, or they may be fixed by means of a screw. Fig. 18 is a top view of the arm piece when separated from the cage; *n, n*, is the arm, attached to the arm piece by two screws or bolts; *o* is the key way, into which a key is

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driven to fix the arm piece to the pole; *p* is a screw for a similar purpose; Fig. 19 shows the same arm piece in elevation; Fig. 32 shows the cage in elevation when made separate from the arm piece. To erect the pole all that is necessary is to mark out the place for the pole and the moorings; four moorings will generally be sufficient for one pole. The base of the pole A is then laid on the surface of the ground or sunk a short distance in the earth. The moorings are closed, as shown in Fig. 4 and 5, and if the ground is soft are driven in at once by inserting the driving fork 15 between the two blades, and forcing it down with a mallet or other suitable means. If the ground be hard we first drive down a bar of wood, which we call a drift; this drift is usually made in the shape of a wedge at one end to facilitate its entering the ground, and armed with metal; the other end has either a ring or cap of metal driven on to it to prevent its splitting when struck; on this drift there is a metal shoe having a lip on one side; this shoe slides freely on the drift, but can be fixed in any position by driving in a wedge between the shoe and the drift. Fig. 20 represents the drift when driven down. *q* is the shoe; *r* is the lip on one side of the shoe; *s* is the wedge to fix the shoe to the drift. After the drift has been driven down, as shown in Fig. 20, the shoe *q* is fixed to the drift by driving in the wedge *s*; the end of a crowbar *t* or any suitable lever is then placed under the lip *r*, as shown in the Drawing, making use of a sleeper or any suitable material for a fulcrum, and the drift forcibly raised to a certain degree; the shoe is then knocked away from the wedge and slipped down the drift and fastened again by driving the wedge in; the lever is then applied as before, and the drift forcibly raised; the shoe is then knocked away from the wedge as before, and the process just described repeated until the drift is extracted. The moorings are then placed down the holes made by the drift, the blades then are forced open to a certain extent by dropping the wedge *g*, Figs. 4 and 5, and driving it between the blades by means of the driving fork, Fig. 15. Earth is now rammed down the holes until they are filled. Stay wires (one for each mooring will generally be sufficient) are then threaded through one side of the iron cage, taken half round the pole, and brought back through the other side of the cage, and the two ends of each wire brought down to their respective moorings. One end of each stay wire is then passed round the pulleys of the moorings and the wires tightened by inserting a draw vice between the two ends and a joint made in the same way as telegraph line wires are tightened and jointed. The act of tightening each pair of stay wires pulls up its respective mooring, the blades of which continue to open until they assume the position shown at *u*, Figs. 1 and 6. Fig. 21 represents a pole so stayed. Two stays only are

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shown in the Drawing. In some cases to obtain greater strength and also greater equality of tension in the stay wires we fit on the pole what we call stay pieces; these slide freely on the pole, but can be fixed in any position by means of a screw or a key; these stay pieces are shown in two positions in Fig. 22, 23; a semicircular groove v is made at the side of the stay piece, which can be fixed at any position on the pole by the screw p; x is a key, the object of which will be explained further on. When these stay pieces are used the stay wires are arranged somewhat differently; one plan of doing it is shown in Fig. 1; one end of the stay wire is fixed to the shank of the mooring f at the side of the pulley and taken up and threaded through the cage, brought down again, as shown by the arrow, passed round the pulley h, and taken up, as shown by the arrow, and passed over the groove v of the upper stay piece and brought down to the opposite mooring f^1, as shown by the arrow, passed round the pulley h^1, taken up to the cage l, threaded through and brought down to the shank of the mooring f^1 and fastened; stay wires are then connected to the two remaining moorings and passed over No. 2 stay piece v^1 in a similar way to that just described. Another plan is to fasten the ends of the stay wires to the cage, as shown in Fig. 24, which is a top view of the cage, and then take one of these wires y down to the mooring pulley f, Fig. 1, pass it round and up to the stay piece v, Fig. 1, over it, and down to the opposite pulley f^1, and up again to the cage, and fasten it as shown at z, Fig. 24. The upper stay piece is now forced up the pole, the effect of this is to tighten the stay wires equally on the opposite sides; the stay piece is then fixed to the pole by means of the screw p, shown in Fig. 22, and the key x driven into it, this bends the stay wire a little in a recess made for this purpose in the key way, and prevents its slipping. No. 2 stay piece v^1, Fig. 1, is now forced up and fastened in the same way as No. 1 stay piece; this tightens the remaining stay wires. Only two of the mooring links are shown in Fig. 1. Any strain these poles are subjected to is chiefly borne by the stays, and as this strain is almost entirely one of tension the stays may be made of comparatively light wire. When, however, it is thought desirable to use very strong stays, we sometimes do away with the cage and the stay pieces and employ the sliding pieces shown at Fig. 25; these sliding pieces can be fixed at any height on the pole by driving in the key x, and are formed into a hook on one side, as shown in Fig. 25. The stays are then made with a hook at one end and a loop at the other, the hook is passed into the link of the moorings, and the loop passed over the hook of the sliding piece, Fig. 25, as many sliding pieces being required as there are stays; these sliding pieces are then forced up the pole until it stands upright, and fastened by driving in the

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keys. The plan we generally adopt for forcing up the stay pieces is shewn by Figs. 26, 27, 28. Fig. 26 is a pulley mounted on the metal cap a^1, which fits easily over the pole; Fig. 27 shows this pulley in another position; Fig. 28 is a clamp working on the joints b^2, and opens to allow it to be placed on the pole. The modus operandi is as follows:—The pulley is placed on the top of the pole previously to raising it in its position. The clamp, Fig. 28, is fixed to the pole by a screw; a bent fork, shown at Fig. 29 and 30, is attached to a rope passing over the pulley, and placed under the stay piece *v*, as shown at Fig. 30; the other end of the rope is brought down, and connected by means of a draw vice with a piece of wire rope or ordinary telegraph wire attached to the clamp, and the stay pieces, Fig. 30, forcibly drawn up. In places confined for room, or where great rigidity is required, as is the case where wires terminate, we usually construct our poles of two uprights, Fig. 31, and attach the wooden arms which carry the insulators to both in such a way that they act as ties or braces to the poles; and we frequently place bars across lower down to obtain increased rigidity; these double poles are generally stayed in a similar way to the single ones, but where great rigidity is required the arms may be made to project beyond the uprights, and the stay wires may be attached to them. Fig. 31 represents these double poles.

Figs. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, are drawn to a scale of 3 inches to a foot; Figs. 1, 2, 3, 20, 31, to a scale of $\frac{3}{4}$ inch to a foot; Fig. 21 to a scale of $\frac{1}{2}$ inch to a foot.

We claim,—

First, the general arrangement of the telegraph posts or supports, as described.

Second, the moorings, which open as described on being subjected to strain.

In witness whereof, I, the said Samuel Alfred Varley, on behalf of myself and the said Cornelius Varley, have hereunto set my hand and seal, the Fourteenth day of November, in the year of our Lord One thousand eight hundred and sixty-five.

SAMUEL ALFRED VARLEY. (L.S.)

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1865.

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A.D. 1865. May 20. N° 1390.
C. & S. A. VARLEY'S SPECIFICATION.

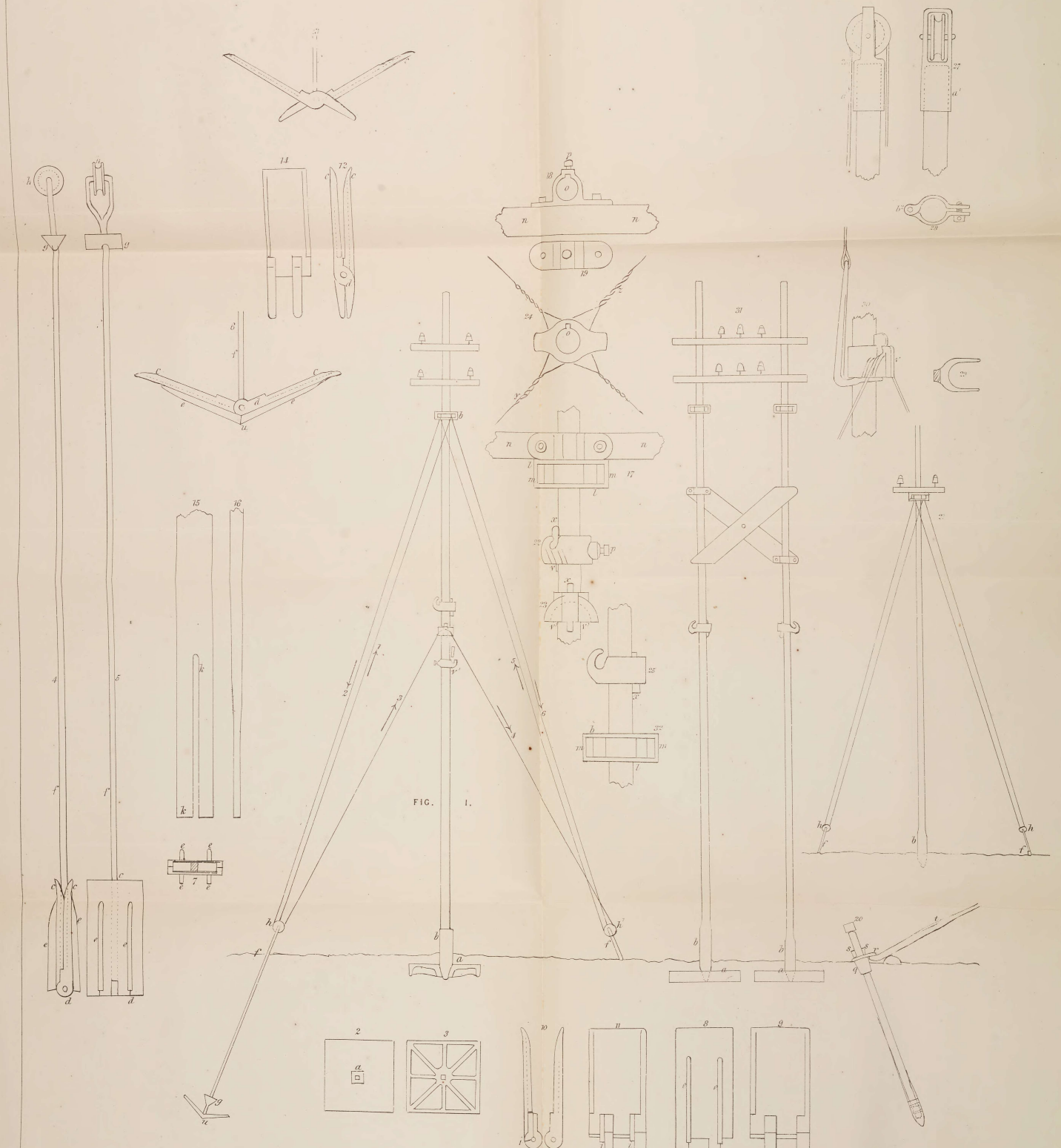

FIG. 1.

The filed drawing is partly colored.

Drawn on Stone by Mabey & Son.

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Printers to the Queen's most Excellent Majesty. 1865.

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